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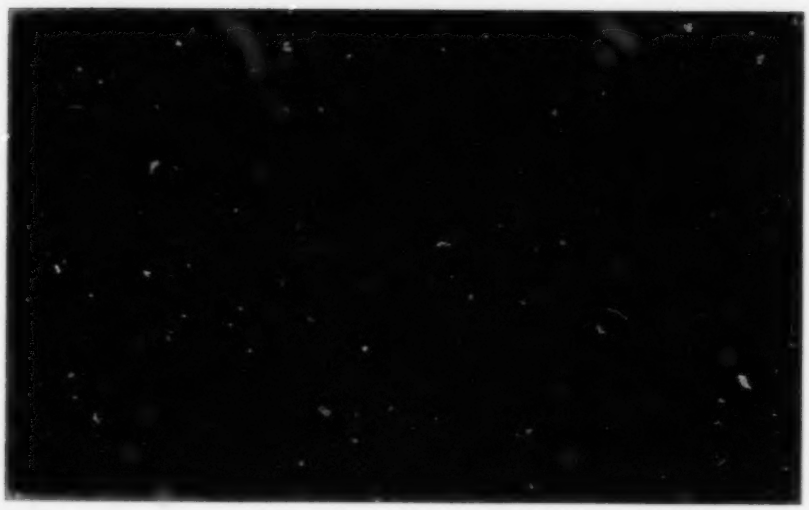

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The Grieving Reaction: A Multivariate Analysis of the Impact of Care Using a Disutility Index *

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ABSTRACT

This study shows that a multivariate analysis enables to identify a number of factors that explain variations of the grieving reaction, notably the effect of the level of accompaniment care and of palliative care. It is also established that the use of a flexible Self-Adjusting index implies an interaction among the different components of the grieving reaction and results that differ significantly from those that would have been obtained with an index built by adding up outcome scores. Furthermore, our sensitivity analysis indicates that correcting for the existing self-selection bias would not modify the general bearing of the results.

Keywords: grieving reaction, accompaniment care, palliative care unit, multivariate analysis, selection participation bias.

RÉSUMÉ

Cette étude montre qu'une analyse multivariée permet d'identifier plusieurs des facteurs explicatifs de la réaction d'endeuillement. Nous montrons aussi l'importance d'utiliser un indice de l'endeuillement qui admet une interaction entre les composantes de la mesure du deuil: on obtient en effet des résultats différents de ceux qu'on aurait obtenus par une simple addition des composantes. Une analyse de sensibilité indique que les conclusions ne dépendent pas du biais de sélection échantillonnale.

Mots clés: réaction d'endeuillement, soins palliatifs, analyse multivariée, biais de sélection échantillonnale.

ZUSAMMENFASSUNG

Die Studie zeigt, daß mit Hilfe einer multivariaten Analyse eine Reihe von Faktoren identifiziert werden kann, die Veränderungen der Trauerreaktion, insbesondere durch das begleitende Umsorgen und die Pflege auf Sterbestationen erklären. Weiterhin wird nachgewiesen, daß die Verwendung eines flexiblen, sich selbständig anpassenden Index auf eine Interaktion zwischen verschiedenen Bestandteilen der Trauerreaktion hinweist und zu Ergebnissen führt, die sich erheblich von denen unterscheiden, die auf der Grundlage eines additiven Index gewonnen worden wären. Schließlich weist unsere Sensitivitätsanalyse darauf hin, daß eine Korrektur um die Verzerrung, die sich aus der vorhandenen Selbstauswahl des Datenmaterials ergibt, die generelle Aussage der Ergebnisse nicht beeinflußt.

Schlüsselbegriffe: Trauerreaktion, begleitende Pflege, Sterbestation, multivariate Analyse, Verzerrung infolge von Selbstauswahl

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THE GRIEVING REACTION: A MULTIVARIATE ANALYSIS OF THE IMPACT OF CARE USING A DISUTILITY INDEX

1 INTRODUCTION

In a first application of a flexible index to the dimensions of outcome following bereavement, we perform a multivariate analysis of its determinants, in particular of the influence of care (defined as both follow up care and palliative care), using a large sample of subjects chosen among visitors of patients at the terminal phase of disease in three large Montreal hospitals.

The sample makes it possible to move away from the emphasis on widows found in many studies. The flexible index allows the data to decide whether grieving discomfort results from the interaction among the dimensions of outcome measured or can be adequately represented by adding up outcome scores.

The multivariate analysis distinguishes the effects of accompaniment and palliative care on the subjects' grieving reaction from those other factors. Indeed, we take into account several factors that can affect the reported grieving reaction of the subjects but have not been considered before, such as the interviewers' bias and the subject's relationship to the deceased (see Table 1).

In the next sections we successively describe the data, the model and its distinctive features with respect to other multivariate models of grieving reaction. Finally, we discuss the statistical and main measurement results.

2 AVAILABLE PANEL DATA

The grieving reaction is defined by the answers to 55 questions, 30 of which consisted of Goldberg's (1972) General Health Questionnaire (Version for the United States). The other questions were largely inspired by Parkes (1972). The questions were grouped under the following categories: psychological (39), somatic (12), relationships with others (3) and activity (1). Three hundred and twelve (312) subjects were interviewed a maximum of three times over a period of two years, the first interview taking place six months after bereavement and the others 7 and 19 months later. The first interview was made in 1980 and the last in 1982.

2.1 SAMPLE

The subjects of the research were the 312 willing participants drawn from the population of all those who had been "key persons" of a patient who had died of cancer in one of three places: 134 participants from the Palliative Care Unit of the Royal Victoria Hospital, 103 participants from elsewhere in the same hospital and 85 participants from the Montreal Convalescent Hospital (which did not have a Palliative Care Unit at that time).

Table 1 gives a breakdown of their characteristics in the sample. All values denote the number of subjects having the relevant characteristic, except the starred values that consist of sample means. A definition ending in MD denotes a "missing data dummy variable". Note that the link to the deceased was broken down into six categories: spouse (162), friend (6), parent (5), son or daughter (90), sibling (31), relative (28). Women (215) are in greater number than men (97); both French (129) and English (107) speaking persons are present. The subjects are Catholic (185), Protestant (55), Jewish (31) or other, including non believing (14). Moreover, some variables attempt to circumscribe the cumulative effect of losses upon bereavement. Account is taken of the civil status of participants and of their socioeconomic categories. Only 61 subjects participated in all three interviews, 89 in the first and second and 82 in the first only. For a more complete description of the data the reader may wish to consult Kiely (1983).

2.2 SUPPLY OF ACCOMPANIMENT CARE

Care consists of accompaniment care (active listening) supplied to the subjects and palliative care supplied to the deceased. Accompaniment care was offered to bereaved subjects in a two-step procedure: first, a random selection of subjects and random assignment to a volunteer or nurse was made. The second step consisted in adjusting the quantity of care according to need and individual preference as to the choice of means, i.e. telephone calls or visits. In a few cases, subjects in great need were given therapeutic help by professionals; these 26 subjects were kept in the sample.

TABLE 1 SAMPLE MEANS OR NUMBER OF SUBJECTS BY CATEGORY, 312 INDIVIDUALS, MONTREAL 1980-1982

TIME OF INTERVIEWS 1-2-3	MON123	61.00	
TIME OF INTERVIEWS 1-2	MON12	89.00	
TIME OF INTERVIEWS 2-3	MON23	39.00	
TIME OF INTERVIEWS 1-3	MON13	8.00	
TIME OF INTERVIEW 1	MON1	82.00	
TIME OF INTERVIEW 2	MON2	32.00	
TIME OF INTERVIEW 3	MON3	1.00	
SPOUSE OF DECEASED	LIENCJT	162.00	
FRIEND OF DECEASED	LIENAMI	6.00	
PARENT OF DECEASED	LIENPRT	5.00	
SON OR DAUGHTER OF DECEASED	LIENFLSE	90.00	
BROTHER OR SISTER OF DECEASED	LIENFRSR	31.00	
RELATIVE OF DECEASED	LIENRELA	18.00	
MONTHS SINCE DEATH	* TEMPSDE	7.65	
PATIENT AGE AT DEATH	* AGEPAT	63.24	
PATIENT AGE AT DEATH MD	AGEPATO	61.00	
SUBJECT AGE AT DEATH	* AGESUJ	53.13	
SUBJECT AGE AT DEATH MD	AGESUJO	32.00	
NUMBER OF MEN	SEXEM	97.00	
NUMBER OF WOMEN	SEXEW	215.00	
FRENCH SPEAKING CANADIAN	CANF	129.00	
ENGLISH SPEAKING CANADIAN	CANA	107.00	
OTHER	CANOTHER	76.00	
CATHOLIC SUBJECT	RELCAT	185.00	
PROTESTANT SUBJECT	RELPROT	55.00	
JEWISH SUBJECT	RELJUIF	31.00	
RELIGION MD	RELO	27.00	
OTHER	RELOTHER	14.00	
MARRIED SUBJECT	SMARIE	256.00	
SEPARATED SUBJECT	SSEPARE	19.00	
WIDOWED SUBJECT	SVEUF	11.00	
SINGLE SUBJECT	SCELIB	26.00	
CHILDREN LESS THAN 14 YEARS	* ENFANTS	0.27	
CHILDREN LESS THAN 14 YEARS MD	ENFANTSO	8.00	
DEPART OF CHILDREN SINCE DEATH	DEPART	28.00	
MAJOR LOSSES SINCE DEATH	PERTES	72.00	
CONCURRENT CRISIS TO DEATH	CRISE	91.00	
CONCURRENT CRISIS TO DEATH MD	CRISEO	32.00	
FINANCIAL EFFECT: IMPROVEMENT	FINA	39.00	
FINANCIAL EFFECT: DETERIORATION	FIND	55.00	
FINANCIAL EFFECT: CONSTANT	FINC	218.00	
SOCIO-EC. CATEGORY: PROFESSIONAL	CSPHP	44.00	
SOCIO-EC. CATEGORY:WHITE COLLAR	CSPHW	50.00	
SOCIO-EC. CATEGORY:UNEMPLOYED	CSPUN	6.00	
SUBJECT NOT WORKING	CSPNW	149.00	
SOCIO-EC. CATEGORY: BLUE COLLAR	CSPBC	57.00	
SOCIO-EC. CATEGORY MD	CSPS	14.00	
PRINCIPAL WAGE EARNER:PROFESSIONAL	OCMHP	62.00	
PRINCIPAL WAGE EARNER:WHITE COLLAR	OCMHW	70.00	
PRINCIPAL WAGE EARNER:UNEMPLOYED	OCMUN	15.00	
PRINCIPAL WAGE EARNER:NOT WORKING	OCMNW	52.00	
PRINCIPAL WAGE EARNER MD	OCMO	33.00	
PRINCIPAL WAGE EARNER BLUE COLLAR	OCMBC	80.00	
TIME BETWEEN DIAGNOSIS AND DEATH	* TEMPSDIA	3.07	
TIME BETWEEN DIAGNOSIS AND DEATH MD	TEMPSDIO	48.00	
R.V.H. HOSPITAL	HOPRVH	103.00	
M.C.H. HOSPITAL	HOPMCH	85.00	
R.V.H. HOSPITAL P.C.U.	HOPPCU	124.00	
REFUSAL OF INTERVENTION	REFUS	12.00	
INTERVENTION	INTERV	182.00	
INTERVENTION CONTROL GROUP	INTERVCG	118.00	
INTERVENTION BY VOLUNTEER	BENEVOLE	79.00	
INTERVENTION BY NURSE	NURSE	103.00	
NUMBER OF VISITS	* NBVISITE	1.90	
NUMBER OF TELEPHONE CALLS	* NBTELEPH	3.56	
PROFESSIONAL INTERVENTION	INTERVS	26.00	
INTERVENTION PERIOD	* DUREEINT	15.58	
INTERVIEWER 1	EVAL1	13.00	
INTERVIEWER 6	EVAL6	19.00	
INTERVIEWER 9	EVAL9	12.00	
INTERVIEWER 21	EVAL21	10.00	
INTERVIEWER 10	EVAL10	13.00	
INTERVIEWER 12	EVAL12	13.00	
INTERVIEWER 14	EVAL14	26.00	
INTERVIEWER 15	EVAL15	22.00	
INTERVIEWER 16	EVAL16	14.00	
INTERVIEWER 18	EVAL18	9.00	
INTERVIEWER 2	EVAL2	21.00	
INTERVIEWER 3	EVAL3	27.00	
INTERVIEWER 4	EVAL4	7.00	
INTERVIEWER 5	EVAL5	15.00	
INTERVIEWER 7	EVAL7	20.00	
INTERVIEWER 19	EVAL19	20.00	
INTERVIEWER 8	EVAL8	5.00	
INTERVIEWER 20	EVAL20	2.00	
INTERVIEWER 13	EVAL13	19.00	
INTERVIEWER 17	EVAL17	23.00	
COPING PREDICTION	* COPING	3.78	
COPING PREDICTION MD	COPINGO	65.00	

Sample means are denoted by (*).

3 GRIEVING REACTION MODEL

3.1 MODEL STRUCTURE

We propose the following model designed to explain the grieving reaction of the i^{th} individual at time t:

$$GR_{it} = C_{is}\beta_1 + H_{it}\beta_2 + T_{it}\beta_3 + D_{it}\beta_4 + S_{it}\beta_5 + N_{it}\beta_6 + Y_{it}\beta_7 + I_{it}\beta_8 + ETC_{it}\beta_9 + \varepsilon_{it}, \quad (1)$$

$$C_{is} = GR_{is}\gamma_1 + X_{is}\gamma_2 + \xi_{is}, \quad (2)$$

$$P_{it} = P_{iq}\delta_1 + E(P_{iu})\delta_2 + GR_{it}\delta_3 + Z_{it}\delta_4 + \zeta_{it}, \quad (3)$$

GR_{it} is observed if $P_{it} \geq P_{it}^c$, (4)

where $s < t$, $q < t$, $u > t$, $t = 1,2,3$, and the coefficients β, γ and δ are vectors.

In equation (1), we assume that the value of the index for each interviewed subject GR_{it} depends linearly upon C_{is} (the accompaniment and professional help received by the subject in period s), H_{it} (the hospital care given to the deceased person), T_{it} (the passage of time), D_{it} (the deceased patient's characteristics and relationship to the subject), S_{it} , N_{it} and Y_{it} (the subject's sociological, environmental and economic characteristics), I_{it} (the interviewer's bias) and other factors ETC_{it} .

The second equation states that C_{is}, the accompaniment support and professional help received by the subjects in period s, which precedes the first interview, is determined by GR_{is}, the grieving level of the subject at that period, and X_{is}, a set of variables peculiar to the intervention process in the hospitals.

Equation (3) indicates that P_{it} , the willingness to participate in the interview t, and, as stated by (4), the possibility of observing GR_{it} , may depend upon the desire to participate in the previous interview (P_{iq}), the expected desire to participate in future interviews ($E(P_{iu})$), the current level of the grieving reaction index (GR_{it}) and other factors (Z_{it}). Equation (4) states that the critical value P_{it}^c determines wether GR_{it} is observed.

The residual terms ε_{it}, ξ_{is} and ζ_{it} are assumed to be identically, independently and normally distributed with constant variances.

Equations (1)-(4) explain the measured grieving reaction of the individuals. The questions presented in the introduction will be answered only with equation (1). We presently explain why the remaining equations are neglected.

3.2 INDEPENDENT ESTIMATION OF GRIEVING EQUATION

Estimation of the parameters of equation of (1) independently from (2) and (3) depends on two conditions: (i) that the observations for equation (1) be randomly selected; and (ii) that the variables on the right hand of (1) be predetermined. Let us address these questions in turn.

3.2.1 SELF SELECTION BIAS WITH ENDOGENOUS FACTORS

The problem posed by the refusal of some individuals to participate at all interviews is an important one and has been recognized by others (Vachon et al., 1982). From Table 1 we can see that refusals represent 23% for the first interview, 29% for the second and 65% for the last one.

The formalization of this problem has been done by Heckman (1972, 1987). The problem is that the grieving reaction of an individual can only be observed if the subject's desire to participate at the interview is sufficiently high, otherwise the subject refuses the interview. This produces a violation of assumption (i) and therefore causes a bias of the estimates of (1). This is so since

$$E(GR_{it} \mid P_{it} > 0) = E(GR_{it}) + \sigma_{13}\frac{\phi(E(P_{it}))}{\Phi(E(P_{it}))} \qquad (5)$$

where $\phi()$ and $\Phi()$, respectively the normal density and cumulative distribution functions, define the inverse Mill's ratio, and σ_{13} is the correlation between ε_{it} and ζ_{it}. Equation (5) shows that the bias comes from a misspecification of the model. This implies that the effects of any variable appearing on the right hand side of (1) on GR_{it} is given not only by the corresponding β coefficient but also through the effects on the expected value of the willingness to participate P_{it}, since GR_{it} appears in Eq. (3).

In the literature on the self selection bias, the willingness to participate P_{it} (which decides the observability of the dependent variable) is assumed to be determined only by variables exogenous to the model. In our case this would mean that only the Z_{it} appear in (3). We however cannot rule out the possibility that the willingness to participate in an interview be affected by the factors (P_{it} , $E(P_{it})$, GR_{it}). Since the subjects know in advance that there are three interviews, the decision to

participate in each one may very well depend upon either the past decisions or the future one. Moreover, the willingness to participate may also be influenced by the contemporary grieving reaction of the subject.

Dagenais and Dagenais (1988) have treated this problem recently in the context of analysis of the scholastic achievement of students. Their general formulation is very similar to the one given by (1), (3), and (4) except that they omitted the terms P_{iq} and $E(P_{iu})$ in (3). One naturally expects that the self selection biases on the estimated parameters resulting from independent estimation of (1) will be small if there is a low correlation of the errors σ_{13}. If the corresponding δ_3 is null, then any β in (1) gives the effect of a variable on the conditional[1] expected value of GR defined in (5)[2]. If δ_3 is not null, the effect further includes the feedback of the variables on Mill's ratio. Dagenais and Dagenais (1988) found that the variables of (1) appearing in (3) had insignificant δ coefficients. In addition to the fact that we expect no significant gains from an eventual selection bias correction because of this result, a complete correction would further take into account the presence of P_{iq} and $E(P_{iu})$ in (3).

We will therefore perform a sensitivity analysis of our results obtained by independent estimation of (1) to the inclusion of a dummy-variable approximation of the last term in (5). This analysis will show that the bias resulting from independent estimation of (1) is probably negligible but that does not imply that the resulting β represent the total effect on the conditional expected value of GR.

3.2.2 EXOGENEITY OF CARE RECEIVED

The second equation of the model describes the way in which the care intervention was done. It is important to note is that, since accompaniment care was supplied before the first interview, the variable C_{it} is predetermined in (1) at time t: this means that independent estimation of (1) poses no estimation problems if we further assume that the error term ε_{it} for the same subject is uncorrelated over time among both its observed (t) and unobserved (s) values. This assumption appears to be reasonable in view of the length of the period between the observed periods (7 and 12 months).

3.3 SPECIFICS OF GRIEVING EQUATION

3.3.1 A SELF ADJUSTING INDEX FOR CATEGORICALLY ORDERED DATA

The SACOD index presented in Gaudry and Laferrière (1988) is defined as

---

[1] Conditional upon GR being observed.
[2] In this case it is equal to the unconditional effect.

$$GR = \left[\left(\prod_{h=1}^{N} \frac{\exp(R_h)}{\exp(R_{max})}\right)^{\frac{1}{N}}\right]^{(\lambda)} \qquad (6-A)$$

$$= \left[\exp\left(\sum_{h=1}^{N} \frac{R_h - R_{max}}{N}\right)\right]^{(\lambda)} \qquad (6-B)$$

where R_h is the numerical value of the answer given to the h^{th} of n questions and R_{max} the maximum possible value. (For expository purposes and without loss of generality, we assume the same maximum and minimum values for every question). Expression (6-A) shows that these values are used to define a ratio of exponential terms for each question; but, because of the properties of exponential functions, the geometric mean of these proportions or ratios is also the mean of the differences, as shown in (6-B). Either argument is subjected to a Box-Cox transformation (BCT) with the parameter λ, i.e.

$$GR = \frac{\left[\exp\left(\sum_{h=1}^{N} \frac{R_h - R_{max}}{N}\right)\right]^{\lambda} - 1}{\lambda} \quad , \text{if } \lambda \neq 0,$$

$$= \sum_{h=1}^{N} \frac{R_h - R_{max}}{N} \quad , \text{if } \lambda = 0 \ . \qquad (7)$$

Note that, if $\lambda = 0$, we obtain the arithmetic mean of deviations from the maximum score. In that special case, there is no interaction among the elements. In the general case, the Box-Cox transformation calibrates this interaction through a multidimensional adjustment of the data, a property that justified calling it the Self Adjusting Categorically Ordered Data (SACOD). Such interactions imply that increases in the R_i scores involve diminishing returns in GR (convexity) if $\lambda < 0$ and increasing returns (concavity) if $\lambda > 0$, as in Figure 1.

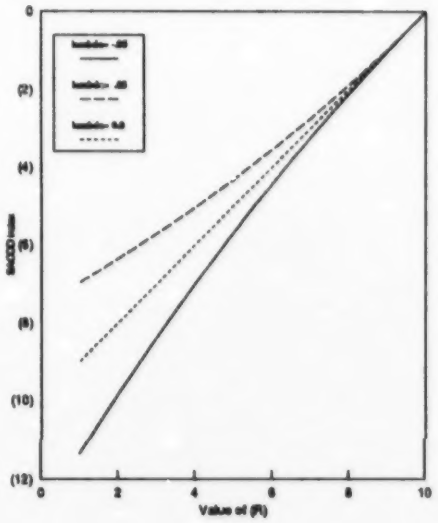


Figure 1 Curvature of the SACOD Index

The paper just mentioned points out that the index is independent from the scale used to situate the relative position of answers and not very sensitive to random errors of 10%. The first property arises because the estimated λ can be shown to be unique and invariant to the scale of answers (Gaudry and Laferrière, 1989). In this case, qualitative answers were assigned values from 1 to 8. The second property appears sufficient to justify cardinalization of ordinal answers by the researchers. Such cardinalization is of course implicit in the standard practice of constructing average scores. Another interesting characteristic of the index, also demonstrated in the former paper, is that, if answers to only one question are considered (i.e. if N=1 in (7)), the index gives results that are extremely close to those that would have been obtained if an ordered logit had been used. However, its comparative advantage over the ordered logit is the possibility to group, for each respondent, the answer to all questions (i.e. N>1) and to detect potential interaction among them (if $\lambda \neq 0$).

The model defined by (1) and (7) is a particular case of a more general model in which to Box-Cox transformation -applied here to the contents of the square brackets in (6)- is applied to both regressand and regressors of a regression model and additionnal parameters insure that the resulting variance of the error term E_{in} is constant (Gaudry and Dagenais, 1979). The model has been successfully used in transportation demand analysis (Dagenais et al., 1987) using the algorithm developed by Liem et al. (1987) that will also be used here.

3.3.2 FACTORS OF SPECIAL INTEREST

The multivariate analysis from (1) allows the identification of the distinct influence on the grieving reaction GR_n of a number of factors, some of which are of specific interest. Consider the factors care (C,H), time (T), relationship to the deceased (D), interviewers (I) and missing data:

C:this class contains identifiers of whether, by whom and how much accompaniment care was provided to the subject;

H:this set identifies the impact on the subject of palliative care supplied to the patient;

T:this group distinguishes the time span between the diagnostic and the patient's death from the time span after the patient's death. This is possible because our sample is not limited to one interview but contains information from the three interviews;

D:many studies have concentrated on the grieving reaction of widows. In our case, we examine not only the widow or widower but enlarge our sample to include other types of relationships to the deceased. We argue that the effect of care (accompaniment and palliative care) on subjects ought to be answered not only with widows but also with persons having other relationships to the deceased, as this may lead to different grieving reactions;

I:others have acknowledged the possibility that the attitude of the interviewers may influence the outcome of the interviews. In order to take into account the possibility of a systematic bias from the interviewers, we include into the list of regressors a binary variable for each interviewer in order to capture differences among them. It is a way of purging the grieving index from the interviewer's relative influence.

Note that, instead of neglecting observations containing missing data or replacing these by some values generated by *ad hoc* procedures, we use for each variable a Boolean variable (identified by the MD suffix at the end of the variable definition) defined as 0 if the subject answered and 1 otherwise. A more thorough approach to this problem (Dagenais 1973, Nijman and Palm 1990) would require an expanded specification of (1)-(4) that would take us beyond the realm of our topic.

3.4 STRUCTURE OF EXPERIMENTS

Our discussion of the effect of care and of other factors on the grieving reaction of individuals in the next section will be done within a framework that takes into account three dimensions of interest: i) the potential existence of a participation bias, explored, as mentioned in Section 3.2.1., by a sensitivity analysis performed by the addition of Boolean variables which describe the possible combinations of interviews; ii) the influence of our index, as opposed to the use of special nested cases such as the arithmetic mean of the deviations (no interaction among the elements ($\lambda = 0$)) and the multiplicative mean of the deviations (a particular interaction case ($\lambda = 1$)); iii) the impact of using 55 outcome elements, instead of Goldberg's General Health Questionnaire 30-component index or other subsets that regroup psychological or somatic elements.

4 RESULTS

4.1 REPORTED EXPERIMENTS AND STATISTICS

Table 2 contains the detailed results of our experiments. The variables influencing the grieving reactions have been regrouped into 7 categories: C (the accompaniment and professional help received by the subject), H (the hospital care given to the deceased person), T (the passage of time), D (the deceased patient's characteristics and relationship to the subject), S (the subject's sociological characteristics), N (the environmental characteristics), Y (the economic characteristics), I (the interviewer's bias) and ETC (other factors). Among these categories, the only ones for which change was recorded over time were: T, N and the first two variables of Y.

The experiments denoted by 7 numbered columns are
1: reference model with SACOD index and 55 elements;
2: participation bias model with SACOD index and 55 elements;
3: reference model with the arithmetic mean index ($\lambda = 0$) and 55 elements;
4: reference model with the multiplicative mean index ($\lambda = 1$) and 55 elements;
5: reference model with SACOD index and Goldberg's 30 elements;
6: reference model with SACOD index and 39 psychological elements;
7: reference model with SACOD index and 12 somatic elements.

Parameter estimates were obtained by maximizing the likelihood of the contents of the square parentheses in (6) under the assumption of normality of the error term, using the L-1.2 algorithm (Liem et al., 1987)[3]. A grid search was done to insure that a global maximum had been found. Table 2 contains, for each experiment performed, results presented in three sections.

The first section lists elasticities of the index defined, for explanatory variables that contain no observed zeroes, as the ratio of the percentage change in the index to the percentage change of the explanatory variable of interest; in the case of categorical ("dummy") variables (identified in Table 2 by code names that are underlined once or twice), elasticities are defined as the percentage change

[3] We checked carefully the appropriateness of this assumption by computing the probability of having limit observations and found no problem.

in the index due to the presence of the categorical variable. Elasticities for both categories of variables are computed for any variable X_k as,

$$\text{Elasticity of GR with respect to } X_k = \frac{\partial GR}{\partial X_k}\frac{\overline{X_k^+}}{\overline{GR}} = \beta\frac{\overline{X_k^+}}{\overline{GR}} ,$$

where $\overline{X_k^+}$ denotes the sample mean computed only with strictly positive observations and $\overline{GR}$ the mean of the dependent variable. As shown in Dagenais et al. (1987), this procedure includes both the standard definition of elasticity (for regressors that contain no observed zeroes), and the elasticity for dummy variables.

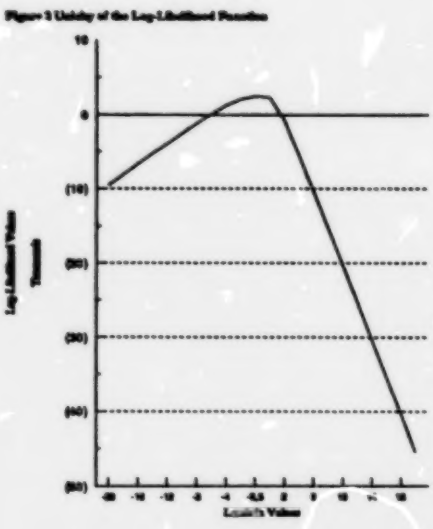
Consider two examples. The variable "months since death TEMPSDE" found in subsection T of the table is a variable that is never equal to zero. In this case, the elasticity values state that a 100% increase in the number of months elapsed since the patient's death reduces the value of the index GR by approximately 9% if the λ is estimated (in all columns but 3 and 4), by 4.2% if the arithmetic mean specification ($\lambda = 0$) is used (Column 3) and by 0.4% if the multiplicative mean specification ($\lambda = 1$) is used (Column 4). By contrast, the variable "intervention (C) INTERV" found in subsection C of the table is a Boolean variable that is equal either to 1 or 0. In this case the elasticity values state that intervention reduces the value of the index GR by approximately 8% except in Columns 3 and 4 where the reduction is 4.6% and 0.6%, respectively, and in Column 7 where the reduction on the Somatic index is 13.6%.

To interpret the elasticities shown in Table 2, one should note that most variables denote mutually exclusive states. To avoid multicollinearity, one state (shown in parentheses at the end of the definition of the variable), is taken as reference state. Under each elasticity, the t-statistic of the regression coefficient is shown in parentheses: it is computed conditionally upon the estimated value of λ. For instance, in Column 1, the variable "friend of deceased (relative) LIENAMI" found in subsection D of the table increases the value of the GR index by 25.2%, which means that friends had GR values 25.2% higher than those of the reference category relatives. The associated t-values of 1.5 indicates that this 25.2% difference between being a friend and being a relative is significant at the 95% level (we have 499 degrees of freedom).

The second section of Table 2 contains estimated values for λ and t-statistics (with respect to 0 and 1, successively). The third section presents general statistics, notably the log-likelihood and the probability that the sample contain observations that would violate the normality assumption of the error term.

4.2 STATISTICAL RESULTS

The grid search done on the reference model (Column 1) insures that a global maximum is found. The result, shown in Figure 1, is important since it insures that the optimum obtained by the algorithm corresponds to the global maximum of the likelihood function. Not only is the shape of the log-likelihood function very steep with respect to the λ parameter but, by comparing Column 4 with Column 1, we see that the geometric mean case corresponding to $\lambda = 1$ substantially reduces the elasticities.



In all models of Table 2, many of the *t*-statistics of individual variables are low, as one expects in models that contain many explanatory variables, especially if large number of variables are categorical variables expressing a difference from an arbitrary reference category. We performed log-likelihood ratio tests on the reference model, removing classes of variables (C, H, T, ..., ETC) one at the time and found that no class could be removed without extremely significant loss of statistical explanatory power.

TABLE 2 DETERMINANTS OF GRIEVING REACTION INDICES, 312 INDIVIDUALS, MONTREAL 1980-1982: ELASTICITIES AND OTHER STATISTICS

ELASTICITIES (T-STATISTICS)	CODE NO. = DEP.VAR. =	1 N55PSRA	2 N55PSRA	3 N55PSRA	4 N55PSRA	5 N30GOLD	6 N39PSY	7 N12SOMA
C = CARE								
REFUSAL OF INTERVENTION (C)	REFUS	.030	.059	.021	-.001	-.005	.018	.016
		(.25)	(.50)	(.36)	(-.05)	(-.04)	(.15)	(.14)
INTERVENTION (C)	INTERV	-.085	-.083	-.046	-.006	-.083	-.078	-.136
		(-1.34)	(-1.30)	(-1.75)	(-.68)	(-1.25)	(-1.21)	(-2.13)
INTERVENTION BY VOLUNTEER (NURSE)	BENEVOLE	-.059	-.065	-.033	-.007	-.056	-.061	-.032
		(-1.14)	(-1.22)	(-1.55)	(-.97)	(-1.06)	(-1.15)	(-.69)
NUMBER OF VISITS	NBVISITE	-.054	-.077	-.022	.003	-.054	-.057	-.028
		(-1.03)	(-1.37)	(-.96)	(.40)	(-1.00)	(-1.06)	(-.58)
NUMBER OF PHONE CALLS	NBTELEPH	.152	.156	.068	.006	.122	.140	.144
		(2.11)	(2.08)	(3.32)	(1.03)	(1.81)	(2.01)	(2.47)
PROFESSIONAL INTERVENTION	INTERVS	.010	.012	.005	-.000	.013	.011	.009
		(1.30)	(1.47)	(1.61)	(-.13)	(1.54)	(1.26)	(1.41)
NUMBER OF WEEKS OF INTERVENTION	DUREEINT	-.015	-.022	-.006	-.005	-.029	-.025	.029
		(-.33)	(-.51)	(-.26)	(-.76)	(-.57)	(-.50)	(.65)
H = HOSPITALS								
R.V.H. HOSPITAL (P.C.U.)	HOPRVH	-.090	-.116	-.044	-.005	-.087	-.095	-.081
		(-1.53)	(-1.78)	(-2.00)	(-.68)	(-1.46)	(-1.56)	(-1.64)
M.C.H. HOSPITAL (P.C.U.)	HOPMCH	-.044	-.044	-.026	-.000	-.064	-.063	-.001
		(-.71)	(-.71)	(-.90)	(-.01)	(-1.03)	(-.94)	(-.01)
T = TIME								
TIME BETWEEN DIAGNOSIS AND DEATH	TEMPSDIA	.008	.006	.002	.001	.007	.009	.005
		(.57)	(.49)	(.30)	(.26)	(.46)	(.66)	(.45)
TIME BETWEEN DIAGNOSIS AND DEATH MD	TEMPSDI0	.037	.030	.032	.011	.049	.033	.057
		(.74)	(.60)	(1.40)	(1.47)	(.95)	(.64)	(1.10)
MONTHS SINCE DEATH	TEMPSDE	-.091	-.089	-.042	-.004	-.092	-.087	-.095
		(-2.09)	(-1.90)	(-2.85)	(-.87)	(-2.03)	(-2.01)	(-2.50)
D = DECEASED								
SPOUSE OF DECEASED (RELATIVE)	LIENCJT	.099	.089	.045	.004	.073	.075	.132
		(1.00)	(.89)	(1.02)	(.26)	(.71)	(.74)	(1.33)
PARENT OF DECEASED (RELATIVE)	LIENPRT	.182	.186	.099	.003	.185	.171	.163
		(.91)	(.93)	(1.20)	(.12)	(1.00)	(.82)	(.86)
FRIEND OF DECEASED (RELATIVE)	LIENAMI	.252	.265	.111	.013	250	.284	.108
		(1.50)	(1.57)	(1.53)	(.44)	(1.40)	(1.57)	(.74)
SON OR DAUGHTER OF DCD (RELATIVE)	LIENFLSE	.155	.186	.059	.004	.064	.156	.128
		(1.57)	(1.73)	(1.51)	(.28)	(.70)	(1.50)	(1.39)
BROTHER OR SISTER OF DCD (RELATIVE)	LIENFRSR	.149	.122	.066	.004	.132	.141	.128
		(1.26)	(1.03)	(1.31)	(.25)	(1.11)	(1.14)	(1.19)
PATIENT AGE AT DEATH	AGEPAT	-.001	-.050	-.001	-.008	.122	.029	-.082
		(0.00)	(-.39)	(-.02)	(-.43)	(.89)	(.22)	(-.66)
PATIENT AGE AT DEATH MD	AGEPAT0	-.013	-.083	.003	-.011	.134	.010	-.076
		(-.10)	(-.59)	(.05)	(-.55)	(.92)	(.07)	(-.57)
S = SOCIOLOGICAL								
SEX (FEMALE)	SEXEM	-.104	-.139	-.048	-.007	-.105	-.105	-.095
		(-1.83)	(-2.12)	(-2.15)	(-.98)	(-1.75)	(-1.77)	(-1.99)
FRENCH SPEAKING CANADIAN (OTHER)	CANF	-.047	-.031	-.007	.006	-.068	-.059	-.018
		(-.69)	(-.44)	(-.23)	(.63)	(-.92)	(-.80)	(-.29)
ENGLISH SPEAKING CANADIAN (OTHER)	CANA	-.060	-.058	-.025	-.005	-.096	-.084	-.011
		(-1.01)	(-1.00)	(-.97)	(-.56)	(-1.45)	(-1.33)	(-.19)
CATHOLIC SUBJECT (OTHER)	RELCAT	-.228	-.247	-.093	-.006	-.207	-.239	-.086
		(-1.70)	(-1.85)	(-1.89)	(-.37)	(-1.81)	(-1.74)	(-.96)
PROTESTANT SUBJECT (OTHER)	RELPROT	-.374	-.402	-.136	-.002	-.328	-.377	-.205
		(-2.10)	(-2.17)	(-2.59)	(-.09)	(-2.14)	(-2.09)	(-1.94)

JEWISH SUBJECT (OTHER)	RELJUIF	-.145	-.156	-.018	.013	-.089	-.165	.003
		(-1.16)	(-1.28)	(-.37)	(.78)	(-.90)	(-1.26)	(.03)
RELIGION MD	RELO	-.321	-.397	-.101	.010	-.262	-.315	-.207
		(-1.86)	(-2.07)	(-1.79)	(.55)	(-1.79)	(-1.81)	(-1.75)
SUBJECT AGE AT DEATH	AGESUJ	.169	.168	.077	.019	.191	.215	.043
		(1.13)	(1.11)	(1.27)	(1.04)	(1.18)	(1.34)	(.33)
SUBJECT AGE AT DEATH MD	AGESUJO	.212	.160	.088	.014	.241	.272	.054
		(1.26)	(1.01)	(1.31)	(.73)	(1.33)	(1.48)	(.40)
MARRIED SUBJECT (SINGLE)	SMARIE	.151	.185	.058	.007	.093	.155	.132
		(1.64)	(1.85)	(1.65)	(.62)	(1.09)	(1.56)	(1.71)
SEPARATED SUBJECT (SINGLE)	SSEPARE	.085	.084	.029	.004	-.010	.077	.099
		(.79)	(.76)	(.54)	(.19)	(-.08)	(.68)	(.97)
WIDOWED SUBJECT (SINGLE)	SVEUF	.330	.333	.134	.004	.228	.303	.283
		(1.90)	(1.90)	(2.37)	(.22)	(1.54)	(1.83)	(1.87)
CHILDREN LESS THAN 14 YEARS	ENFANTS	-.001	-.004	.001	.001	.000	-.002	.002
		(-.14)	(-.45)	(.29)	(.58)	(.03)	(-.24)	(.29)
CHILDREN LESS THAN 14 YEARS MD	ENFANTSO	-.083	-.111	.012	.010	.041	-.061	-.086
		(-.61)	(-.78)	(.19)	(.52)	(.28)	(-.41)	(-.75)
N - ENVIRONMENTAL								
DEPART.OF CHILDREN SINCE DEATH (NO)	DEPART	.098	.110	.027	.004	.088	.102	.068
		(1.38)	(1.52)	(.99)	(.55)	(1.26)	(1.41)	(1.13)
MAJOR LOSSES SINCE DEATH (NO)	PERTES	.054	.051	.039	.008	.077	.040	.083
		(1.23)	(1.18)	(2.17)	(1.51)	(1.52)	(.94)	(1.87)
CONCURRENT CRISIS TO DEATH (NO)	CRISE	.152	.144	.077	.014	.128	.160	.117
		(2.21)	(2.11)	(3.72)	(2.15)	(2.11)	(2.22)	(2.29)
CONCURRENT CRISIS TO DEATH MD	CRISEO	-.035	-.046	-.019	-.001	-.059	-.055	.021
		(-.53)	(-.66)	(-.56)	(-.10)	(-.84)	(-.78)	(.30)
Y - ECONOMIC								
FINANCIAL EFFECT; IMPROVEMENT (C)	FINA	.049	.033	.023	.002	.017	.033	.066
		(.91)	(.63)	(.93)	(.25)	(.33)	(.62)	(1.23)
FINANCIAL EFFECT; DETERIORATION (C)	FIND	-.227	-.244	-.120	-.016	-.179	-.227	-.179
		(-2.58)	(-2.58)	(-6.44)	(-2.79)	(-2.38)	(-2.53)	(-2.88)
SOCIO-EC. CATEGORY; PROFESS. (BC)	CSPWP	.121	.120	.064	.008	.092	.102	.139
		(1.11)	(1.17)	(1.39)	(.54)	(.91)	(.94)	(1.29)
SOCIO-EC. CATEGORY;WHITE COLLAR (BC)	CSPWW	.171	.177	.088	.013	.122	.185	.123
		(1.63)	(1.63)	(2.13)	(1.00)	(1.22)	(1.64)	(1.36)
SOCIO-EC. CATEGORY;UNEMPLOYED (BC)	CSPUN	.435	.393	.253	.052	.372	.404	.529
		(1.96)	(1.91)	(3.77)	(2.92)	(1.70)	(1.82)	(2.59)
SUBJECT NOT WORKING (BC)	CSPNW	.051	.031	.022	-.001	.027	.026	.083
		(.75)	(.47)	(.72)	(-.13)	(.42)	(.38)	(1.16)
SOCIO-EC. CATEGORY MD	CSPO	.009	-.022	-.006	-.002	-.033	-.033	.089
		(.08)	(-.20)	(-.10)	(-.13)	(-.27)	(-.28)	(.78)
PRINCIPAL WAGE EARNER;PROFESS.(BC)	OCMWP	-.071	-.071	-.044	-.005	-.070	-.039	-.125
		(-.80)	(-.82)	(-1.13)	(-.39)	(-.82)	(-.46)	(-1.27)
PRINCIPAL WAGE EARNER;W.COLLAR (BC)	OCMWW	-.224	-.217	-.119	-.015	-.186	-.215	-.217
		(-2.11)	(-2.01)	(-3.64)	(-1.36)	(-1.88)	(-2.07)	(-2.45)
PRINCIPAL WAGE EARNER:UNEMPLOY.(BC)	OCMUN	-.035	-.057	-.014	-.001	-.075	.007	-.182
		(-.33)	(-.54)	(-.30)	(-.03)	(-.70)	(.07)	(-1.61)
PRINCIPAL WAGE EARNER;NOT WORK.(BC)	OCMNW	-.111	-.096	-.050	-.001	-.137	-.098	-.140
		(-1.36)	(-1.19)	(-1.54)	(-.05)	(-1.58)	(-1.24)	(-1.63)
PRINCIPAL WAGE EARNER MD	OCMO	-.118	-.104	-.049	-.006	-.097	-.120	-.098
		(-1.44)	(-1.24)	(-1.35)	(-.46)	(-1.20)	(-1.44)	(-1.29)
I - INTERVIEW								
INTERVIEWER 1 (17)	EVAL1	-.413	-.440	-.148	-.012	-.377	-.445	-.223
		(-2.20)	(-2.24)	(-3.17)	(-.76)	(-1.96)	(-2.26)	(-1.54)
INTERVIEWER 6 (17)	EVAL6	.003	-.006	.001	-.004	-.007	-.037	.098
		(.03)	(-.07)	(.03)	(-.29)	(-.07)	(-.42)	(.99)
INTERVIEWER 9 (17)	EVAL9	.152	.177	.091	.029	.302	.150	.177
		(1.32)	(1.48)	(1.96)	(2.17)	(2.04)	(1.25)	(1.58)
INTERVIEWER 21 (17)	EVAL21	-.169	-.171	-.080	-.009	-.172	-.181	-.123
		(-1.48)	(-1.52)	(-1.71)	(-.58)	(-1.40)	(-1.55)	(-1.17)
INTERVIEWER 10 (17)	EVAL10	-.008	-.034	.004	-.007	.004	-.018	.017
		(-.09)	(-.39)	(.10)	(-.40)	(.04)	(-.19)	(.18)
INTERVIEWER 12 (17)	EVAL12	-.105	-.098	-.036	-.005	-.148	-.120	-.050
		(-.90)	(-.90)	(-.57)	(-.25)	(-1.17)	(-.98)	(-.45)
INTERVIEWER 14 (17)	EVAL14	-.127	-.180	-.056	-.004	-.085	-.125	-.125
		(-1.29)	(-1.64)	(-1.37)	(-.28)	(-.60)	(-1.23)	(-1.39)
INTERVIEWER 15 (17)	EVAL15	-.225	-.274	-.073	-.002	-.191	-.236	-.138
		(-1.89)	(-2.07)	(-1.62)	(-.17)	(-1.69)	(-1.92)	(-1.41)

INTERVIEWER 16 (17)	EVAL16	.068	.033	.018	.001	.202	.064	.104
		(.57)	(.28)	(.32)	(.03)	(1.51)	(.53)	(.75)
INTERVIEWER 18 (17)	EVAL18	-.063	-.061	-.014	.001	-.034	-.032	-.103
		(-.63)	(-.61)	(-.30)	(.10)	(-.37)	(-.33)	(-1.09)
INTERVIEWER 2 (17)	EVAL2	-.119	-.095	-.068	-.014	-.030	-.148	-.073
		(-1.12)	(-.91)	(-1.44)	(-.70)	(-.30)	(-1.32)	(-.71)
INTERVIEWER 3 (17)	EVAL3	-.019	-.031	.023	.003	.053	-.025	.029
		(-.22)	(-.34)	(.56)	(.21)	(.58)	(-.27)	(.32)
INTERVIEWER 4 (17)	EVAL4	-.048	-.087	-.004	-.005	.049	-.068	-.020
		(-.36)	(-.59)	(-.06)	(-.13)	(.35)	(-.47)	(-.15)
INTERVIEWER 5 (17)	EVAL5	-.043	-.075	-.030	-.017	-.018	-.086	.027
		(-.36)	(-.62)	(-.57)	(-.98)	(-.16)	(-.68)	(.24)
INTERVIEWER 7 (17)	EVAL7	.011	-.015	-.008	.002	.102	.017	-.013
		(.09)	(-.12)	(-.15)	(.12)	(.76)	(.14)	(-.10)
INTERVIEWER 19 (17)	EVAL19	-.061	-.098	-.025	-.006	.014	-.079	-.045
		(-.66)	(-.97)	(-.57)	(-.40)	(.15)	(-.83)	(-.48)
INTERVIEWER 8 (17)	EVAL8	.165	.093	.084	.003	.318	.176	.028
		(1.06)	(.56)	(1.33)	(.12)	(1.63)	(1.08)	(.18)
INTERVIEWER 20 (17)	EVAL20	.238	.171	.117	-.003	.241	.148	.409
		(.60)	(.65)	(.95)	(-.10)	(.47)	(.45)	(.83)
INTERVIEWER 13 (17)	EVAL13	-.033	-.051	-.021	-.006	.102	-.049	-.011
		(-.29)	(-.44)	(-.42)	(-.37)	(.82)	(-.42)	(-.11)
ETC = ET CETERA								
COPING PREDICTION	COPING	-.190	-.211	-.114	-.020	-.157	-.198	-.112
		(-2.04)	(-2.17)	(-3.64)	(-2.09)	(-1.80)	(-2.01)	(-1.56)
COPING PREDICTION MD	COPINGD	-.165	-.164	-.113	-.021	-.135	-.165	-.108
		(-1.66)	(-1.65)	(-2.91)	(-1.72)	(-1.43)	(-1.63)	(-1.23)
CONSTANT	CONSTANT	-3.430	-3.220	-4.840	-35.900	-3.980	-3.620	-4.070
		(-2.80)	(-2.72)	(-9.36)	(-29.84)	(-2.78)	(-2.78)	(-3.84)
P = PARTICIPATION								
TIME OF INTERVIEWS 1-2 (1-2-3)	MOM12	.056						
		(1.09)						
TIME OF INTERVIEWS 2-3 (1-2-3)	MOM23	.140						
		(1.77)						
TIME OF INTERVIEWS 1-3 (1-2-3)	MOM13	.217						
		(1.88)						
TIME OF INTERVIEW 1 (1-2-3)	MOM1	.174						
		(2.01)						
TIME OF INTERVIEW 2 (1-2-3)	MOM2	.214						
		(2.02)						
TIME OF INTERVIEW 3 (1-2-3)	MOM3	.770						
		(0.00)						

PARAMETERS	CODE NO. =	1	2	3	4	5	6	7
(T-STATISTICS)	DEP.VAR. =	N55PSRA	N55PSRA	N55PSRA	N55PSRA	N30GOLD	N39PSY	N12SOMA
BOX-COX TRANSFORMATIONS								
LAMBDA(Y)	LAM Y	-.534	-.544	0.000	1.000	-.510	-.532	-.316
		(-8.14)	(-8.14)	FIXED	FIXED	(-7.56)	(-8.06)	(-6.49)
		(-23.37)	(-23.12)			(-22.40)	(-23.23)	(-27.03)
LOG-LIKELIHOOD		2427.525	2439.985	2333.413	1230.149	2469.097	2418.922	2079.572
PSEUDO-R2		.990	.990	.986	.307	.995	.992	.992
NUMBER OF OBSERVATIONS		570	570	570	570	570	570	570
SAMPLE -FIRST OBSERVATION		1	1	1	1	1	1	1
-LAST OBSERVATION		570	570	570	570	570	570	570
NUMBER OF INDEPENDENT VARIABLES		71	77	71	71	71	71	71
AVERAGE PROBABILITY (Y=LIMIT OBSERVATION)		0.000	0.000	0.000	0.000	0.000	0.000	0.000

4.3 OVERALL COMMENTS

4.3.1 SELF-SELECTION PARTICIPATION BIAS

Column 2 illustrates the participation bias. Even though variables used are crude measures of the participation decision, we expect them to be sufficiently correlated with a more appropriate indicator of the willingness to participate to be indicative of the potential presence of the bias. We find that the inclusion of the participation variables causes very minor changes in the estimates of the parameters of the model. Recalling the discussion in section 3.2.1, a low correlation of the errors, σ_{13} in (5), may be the cause of this result.

However, by looking at the estimates of the participation variables we observe that the greater the number of interviews the smaller the grieving reaction level. This could indicate a systematic influence of the grieving reaction on the decision to participate in the interviews, or mean that we suspect a δ_3 non-null coefficient in Equation (3).

4.3.2 USE OF THE SELF-ADJUSTING INDEX

The columns 3 and 4 of Table 2 clearly show the benefit from using the Box-Cox transformation: the optimal model in Column 1 indicates an optimal model with a clearly concave form because λ is negative and significantly different from zero. The considerable drop in likelihood between Column 1 and Column 3 indicates that the linear arithmetic mean model is clearly inferior to the self-adjusted model: this is of interest because researchers sometimes add the scores obtained on different items to obtain an overall score: that is close to setting the λ at zero in our model[4]. Similarly, the geometric mean model implied by setting $\lambda = 1$ is rejected even more strongly than the arithmetic mean model, as the drop in likelihood shown in Column 4 indicates. The optimal model of the first column implies diminishing marginal contributions to grieving of higher scores on any of the 30 items. Because the estimated value of λ differs from 0, the results also imply that there is an interaction among the different dimensions or components of grieving included in the index, as is clear from the product formulation (6-A).

[4] Our procedure is not a simple addition of scores, but of deviations from the maximum score, in that case.

4.3.3 INDEX COMPOSITION

The columns 5 to 7 show that different results can be achieved by looking at different expressions of the grieving reaction. For instances the somatic reaction implies not only sign inversions of some factors, such as the variable "number of weeks of intervention (DUREEINT)", but also modifies their relative importance, as for the variable "friend of deceased (relative) (LIENAMI)".

4.4 SPECIFIC COMMENTS BY CATEGORY

In this section, we discuss variables by category, basing our comments primarily on the reference model of Column 1.

4.4.1 EFFECTIVENESS OF INTERVENTION

Accompaniment care (INTERVENTION), most of which was given during the 6-month period previous to the first interview, reduces by .08% the grieving reaction, holding everything else constant. If it is done by a volunteer, then the decrease is amplified by .06%.

Since the follow-up care was adjusted to the subject's needs, it is not surprising to find that the number of phone calls and additional professional intervention are associated with a higher grieving level, since this additional care is by definition supplied to worst off cases. It may also be the case that such supplemental care hinders the subjetc's process of learning to live without the deceased person. Even though accompaniment care has the expected effect on grieving, this does not mean that it is a decisive one, as an examination of other elasticities readily shows.

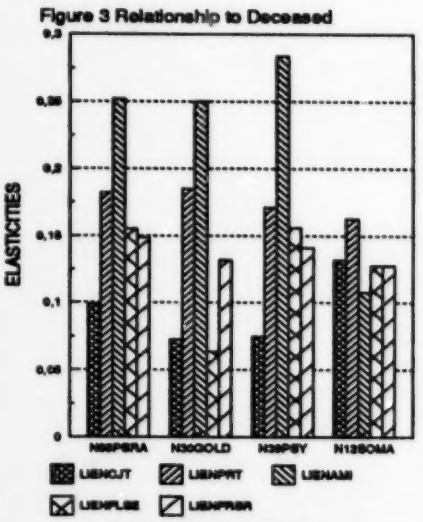
4.4.2 EFFECT OF PALLIATIVE CARE UNIT ON THE SUBJECTS

The subjects are much less affected by grief if the deceased was not in a palliative care unit: they are .09% better off if the patient was at the R.V.H. hospital and .04% better off if the patient was at the M.C.H. hospital. This somewhat surprising result may be due to the fact that palliative care units don't give enough room to negative feelings of subjects because of the domestication of death.

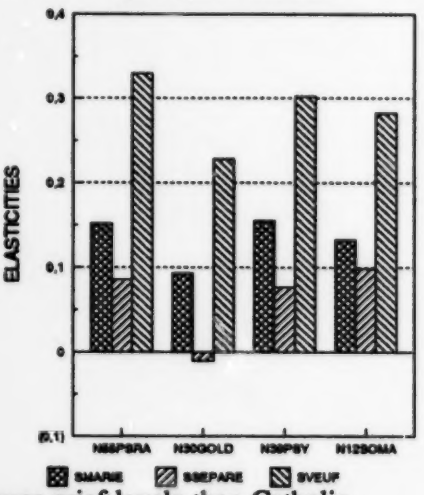
4.4.3 OTHER

T:as expected, time elapsed since death (TEMPSDE) heals because of the nature of bereavement as a "working through". This result is consistent with that found in Kiely and Strobel (1985) whose analysis pertained to subjects who had participated in all three interviews.

D:it is interesting to note that spouses[5] of the deceased (LIENCJT) are generally not the most affected by grief: only in the case of the somatic index of Column 7 do we have, as shown in Figure 2 where the results are reproduced, all subjects roughly as affected in comparison with relatives (the reference group). Moving away from the emphasis on widows and widowers found in other studies does not ease the task of understanding why, friends (LIENAMI) are the worst off group. These results are consistent with the view that the deeper the grief, the more difficult it is to express it in non-somatic way.



S:three of the sociological descriptors of subjects have significant and expected signs in the reference and in other models. The first one, being male (SEXEM) implies a lower grief level: this is consistent with the view that women invest more heavily in interpersonal relationship then men and, on a more psychoanalytical level, have more complexified relationships that could trigger more difficult bereavement. Grief, however, is higher with age (AGESUJ) and if one is already widowed (SVEUF)**both indicating the accumulation of loss.



We also note that Protestant subjects (RELPROT) have lower grief levels than Catholic subjects (RELCAT) for all indices including the somatic index (Column 7); it may be that this result can be related to the protestant ethic. Another surprising result is that married subjects (SMARIE) experience higher grief levels with all indices than the reference group (consisting of singles), as clearly shown in Fig.3. This may be an indication of a greater capacity of attachment on the part of the former group.

N:all three variables describing unfavorable modifications in the subjects' environment since the patient's death increase the level of grief.

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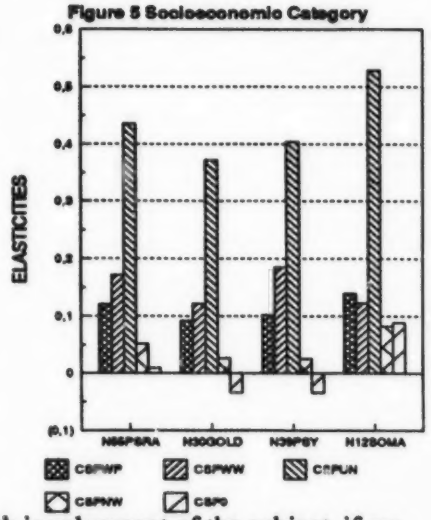
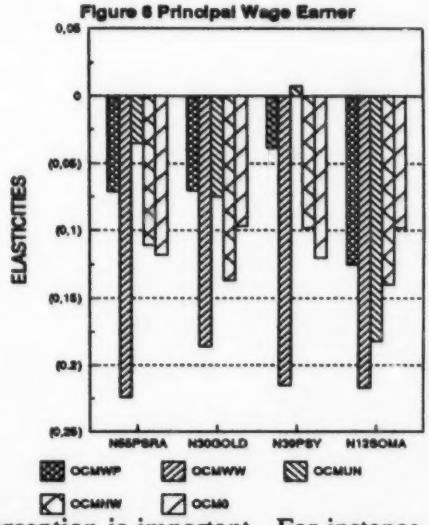
[5] Marie Bonaparte (*Tristesse Féminine*, unpublished manuscript, 1913, reported in Bertin, 1982) might have had a point when she wrote: "L'oppression du mariage est une maladie universelle, si nécessaire, et j'ose croire qu'il est davantage de veuves délivrées que de veuves éplorées"

Y:among economic factors, the first result of interest is that a financial improvement due to the patient's death has no significant effect on the level of grief while a financial deterioration reduces the level of grief. This factor was also taken into account by Flatt (1988). The result may suggest that meeting daily needs produces an occupational form of therapy. A similar interpretation can be given to the fact that belonging to the professional (CSPWP), white collar (CSPWW) and unemployed (CSPUN) socioeconomic categories implies higher levels of grief than belonging to the reference blue collar category.



As shown in Fig.4, the level of grief generally decreases with involvement of the subject, if we assume that professionals are (physically?) busier than white collars and that the unemployed are the least busy.

The economic status of the principal wage earner of the subject's household can be interpreted as a cultural indicator. Setting aside the not working (retired) group, we first note in Fig.5 that all such environments imply lower grief levels than that of the reference (blue collar) environment. We also note that, neglecting households in which the principal wage earner is not working or retired (OCMNW), professional environments (OCMWP) imply higher grief levels that white collar (OCMWW) environments. The reason for these differences may be due to different levels of verbalization.



I:it is clear that accounting for the interviewer's relative perception is important. For instance, interviewers 1 and 15 record much lower scores, while interviewers 8 and 9 record much higher scores, than reference interviewer 17.

C:predictions of coping ability made by nurses (COPING) suggest that the subject's projected impression goes in the same direction as his effective subsequent reaction. This variable is related to the Personality Factors used by Sheldon et al. (1981) and yields similar results.

5 CONCLUSION

We have shown that a multivariate analysis made it possible to identify a number of factors that explain variations of the grieving reaction, notably the effect of the level of accompaniment care and of palliative care. The multivariate analysis has also enabled us to identify the relevance of accompaniment care, a differentiated influence of a palliative care unit, the healing role of time, relationships to the deceased, the socioeconomic status of the bereaved person, as well as the significance of the heterogeneous perceptions of the interviewers. It was also established that the use of a flexible Self-Adjusting index implied an interaction among the different components of the grieving reaction and results that differ significantly from those that would have been obtained with an index built by adding up outcome scores. Furthermore, our sensitivity analysis indicated that correcting for the existing self-selection bias would not have modified the general bearing of the results.

6 BIBLIOGRAPHY

BERTIN C., "**La Dernière Bonaparte**", Perrin, 1982, p.192.

DAGENAIS D.L. and M.G. DAGENAIS, "Modèle d'Analyse du Cheminement des Étudiants dans un Programme Universitaire de Premier Cycle", **Annales d'Économie et de Statistique**, 10, 1988, p.75-96.

DAGENAIS M.G.," The Use of Incomplete Observations in Multiple Regression Analysis", **Journal of Econometrics**, 1(4), 1973, p.317-328.

DAGENAIS M.G., M.J.I. GAUDRY and T.C. LIEM, "Urban Travel Demand: An Impact of Box-Cox Transformation with Nonspherical Residual Error", **Transportation Research B** 21(6), 1987, 443-477.

FLATT B., "Factors Affecting Grief Adjustment", **Journal of Religion and Health**, 27(1), Spring 1988, p.8-18.

GAUDRY M.J.I. and M.G. DAGENAIS, "Heteroscedasticity and the Use of Box-Cox Transformations", **Economics Letters** 2, 3, 225-229, 1979.

GAUDRY M.J.I. and R. LAFERRIERE, "A Self Adjusting Index for Categorically Ordered Data", Centre de Recherche sur les Transports, Publication 601, Université de Montréal, 1989.

GOLDBERG D., "The Detection of Psychiatric Illness by Questionnaire", **Institute of Psychiatry Maudsley Monographs 21**, London, Oxford University Press, 1972.

HECKMAN J., "Shadow Prices, Market Wages and Labor Supply", **Econometrica** 42(4), 1972, 679-694.

HECKMAN J., "Selection Bias and Self-Selection", in **The New Palgrave, A Dictionary of Economics**, 4, 287-297, Macmillan Press, 1987.

KIELY M.C., "National Health and Welfare", Département de psychologie, Université de Montréal, 1983.

KIELY M.C. and M.G. STROBEL, "Evaluation of a Bereavement Intervention Program", Département de psychologie, Université de Montréal, 1985.

LIEM T.C., M.G. DAGENAIS and M.J.I. GAUDRY, "L-1.2: A Program for Box-Cox Transformations in Regression Models with Heteroskedastic and Autoregressive Residuals", Centre de Recherche sur les Transports, Publication 510, Université de Montréal, 1987.

NIJMAN, T.E. and F.C. PALM, "Consistent estimation of regression models with incompletely observed exogeneous variables", Forthcoming in **Journal of Econometrics**, 1990.

PARKES C.M., **Bereavement: Studies of Grief in Adult Life**, New-York, International Universities Press, 1972.

SHELDON A.R., J. COCHRANE, M.L.S. VACHON, A. LYALL, J. ROGERS, and S.J.J. FREEMAN, "A Psychological Analysis of Risk of Psychological Impairment Following Bereavement", **The Journal of Nervous and Mental Disease**, 169(4), 1981, p.253-255.

VACHON, M.L.S., J. ROGERS, A. LYALL, W.J. LANCEE, A.R. SHELDON, and S.J.J. FREEMAN, "Predictors and Correlates of Adaptation to Conjugal Bereavement", **American Journal of Psychiatry**, 139:8, August 1982, p.998-1002.